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ENSAFE

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY
NAVAL BASE CHARLESTON
CHARLESTON, SOUTH CAROLINA
CTO-029

FINAL COMPREHENSIVE HEALTH AND SAFETY PLAN
RCRA FACILITY INVESTIGATION
PAGE CHANGES, REVISION NO: 02

Prepared for:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CHARLESTON, SOUTH CAROLINA

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VOLUME IV

ACRONYM LIST

ACGIH	American Council of Governmental Industrial Hygienists
AL	Action Level
AOC	Area of Concern
CFR	Code of Federal Regulations
CGI	Combustible Gas Indicator
CHASP	Comprehensive Health and Safety Plan
CRZ	Contamination Reduction Zone
CSAP	Comprehensive Sampling and Analysis Plan
°F	Degrees Fahrenheit
DOD	Department of Defense
E/A&H	EnSafe/Allen and Hoshall
EZ	Exclusion Zone
FEV	Forced Exhalation Volume
FEVI	First, Forced Vital Capacity
FVC	Forced Vital Capacity
HAZWOPER	Hazardous Waste Operations and Emergency Response
IDLH	Immediately Dangerous to Life and Health
kv	Kilovolts
LEL	Lower Explosive Limit
mm	Millimeter
MSDS	Material Safety Data Sheet
NAVBASE	Naval Base Charleston
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PA	Posterior Anterior
PCB	Polychlorinated Biphenyls
PEL	Permissible Exposure Limit
PHSO	Project Health and Safety Officer
PID	Photoionization Detector
PAH	Polycyclic Aromatic Hydrocarbon
PPE	Personal Protective Equipment
PWD	Public Works Department
RCRA	Resource Conservation and Recovery Act
REL	Recommended Exposure Limit
RFI	RCRA Facility Investigation
RPM	Revolutions Per Minute
SAR	Supplied-Air Respirator
SCBA	Self-Contained Breathing Apparatus
SHSO	Site Health and Safety Officer
SOP	Standard Operating Procedures
SOUTH-NAVFACENGCOM	Southern Division Naval Facilities Engineering Command
SSHSP	Site-Specific Health and Safety Plan
SWMU	Solid Waste Management Unit

SZ	Support Zone
TLV	Threshold Limit Values
VOA	Volatile Organic Analysis
ZHASP	Zone Specific Health and Safety Plan

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1.0 INTRODUCTION

A Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) is being conducted at the Naval Base Charleston (NAVBASE), Charleston, South Carolina. This program will assess the nature and extent of contamination at locations that have been designated as solid waste management units (SWMUs), and areas of concern (AOCs) and will determine if follow up action is required to comply with environmental regulations. The term "site" is used when referring to an individual SWMU.

This Comprehensive Health and Safety Plan (CHASP) applies field operations conducted at NAVBASE. The Navy project contract number with EnSafe/Allen & Hoshall (E/A&H) is N62467-89-D-0318. Zone Health and Safety Plans (ZHASPs) will be developed to supplement this CHASP by addressing health and safety within an investigative zone. In addition, within an investigative zone there may exist site specific concerns that would not be adequately discussed in the ZHASP. Therefore, within the ZHASP a chapter is dedicated (as needed) to discuss site specific-concerns such as: site specific work tasks, contaminants of concern, decontamination procedures, action levels and monitoring procedures.

Applicability

The provisions of this plan are mandatory for E/A&H personnel. E/A&H personnel shall read this plan and sign the plan acceptance form (see Appendix A) before starting site activities. In addition, personnel will adhere to the most current requirements of 29 Code of Federal Regulations (CFR) 1910.120, *Standards for Hazardous Waste Workers and Emergency Responders* (HAZWOPER). These regulations include the following provisions for employees involved in cleanup operations covered by RCRA: training 1910.120(e), medical surveillance 1910.120(f), and personal protective equipment (PPE) 1910.120(g).

All Department of Defense (DOD) Navy personnel, visitors, and non-E/A&H personnel present in E/A&H work areas, including subcontractors, either shall adopt and abide by this CHASP and

the corresponding ZHASP, or shall have their own safety plans which, at a minimum, meet the requirements of the E/A&H CHASP and ZHASP.

2.0 SITE CHARACTERIZATION

Upon review of available information[1] the following categories of chemical contaminants represent the known or suspected onsite contaminants: heavy metals, polychlorinated biphenyls (PCBs), pesticides, radioactive mixed waste volatile and semivolatile organic compounds associated with gasoline and fuel oils, caustics, polycyclic aromatic hydrocarbons (PAHs), and chlorinated solvents and degreasing agents. Specific compounds known to be present at one or more sites include: lead, mercury, chromium, cadmium, benzene, toluene, DDT (and associated degradation products), PCBs, methylene chloride, and butylbenzyl phthalate.

2.1 Work Areas

Site control for all work areas will be established and maintained according to recommendations in the U.S. Environmental Protection Agency's (USEPA) *Interim Standard Operating Safety Guides*, revised September 1982. Accordingly, three zones of operation, described below, will be established to reduce chemical exposures to E/A&H personnel and the general public and to reduce the potential for contaminant migration. The three zones are the:

- Exclusion zone (EZ) or hot zone.
- Contamination reduction zone (CRZ); and
- Support zone (SZ).

Field personnel shall enter the SZ and don their PPE, then move through the CRZ and into the EZ. After completing their work, or when taking a break, they will leave the EZ through the CRZ. Personnel and equipment will be decontaminated in the CRZ. Personnel shall exit the work area through the SZ.

[1] Known information for each SWMU and AOC is discussed in the *Zone Specific RFI Work Plan Prepared for NAVBASE.*

The exclusion zone is the area being investigated, sampled, or that is otherwise of interest. It is where chemical contamination is known or suspected to exist. The EZ includes the work area except for areas set aside as either the CRZ or SZ. The EZ will be defined and demarcated in the field. In the case of drilling, the EZ is typically about 50 feet in diameter with the borehole located in the middle.

Personnel that enter the CRZ and EZ shall meet all requirements specified in 29 CFR 1910.120(e); this includes initial health and safety training, annual refresher training, and supplemental training required for onsite supervisors. Before entering the EZ, and at all times when in the EZ, all personnel shall be outfitted in and properly use all required PPE. A checkpoint may be established at the EZ's edge to regulate the equipment and personnel flow in and out of the area.

When using Level A, B, or C PPE, all personnel entering the EZ must use the "buddy system." Under these conditions, all persons entering the EZ must be able to:

- Provide his or her partner with assistance.
- Observe his or her partner for signs of chemical exposure and heat stress.
- Periodically check the integrity of his or her partner's protective clothing.
- Notify the support personnel (in the SZ), or others if emergency help is needed.

Additionally, at least one person shall remain outside the EZ and have available at least the same level of PPE as those entering the EZ. The person outside the EZ will provide logistical and safety support as needed. At least one E/A&H employee currently certified in first aid will be onsite during site activities.

The contamination reduction zone serves as a buffer between the EZ and the SZ and is intended to prevent the spread of contaminants from the work areas. All decontamination procedures will

be conducted here. The CRZ shall be adjacent to and upwind of the EZ, all decontamination stations and operations shall be conducted within the CRZ. When leaving the SZ and entering the CRZ, personnel must be wearing the prescribed PPE. Exiting the CRZ requires removing all contaminants through compliance with established decontamination procedures as contained herein (Section 6.4) and in the corresponding ZHASPs.

The support zone is the outermost area and is considered a non-contaminated or clean area. The support area will be equipped with an appropriate first-aid station and equipment to support activities occurring in the EZ and CRZ. The SZ is adjacent to and upwind of the CRZ. The actual location and boundary of work zones will be determined and demarcated in the field. Existing site conditions such as wind direction, location of utilities, roads, security, etc., shall be considered when determining zone locations.

Meteorologic or site condition changes may necessitate relocating the CRZ or SZ.

2.2 Work Area Access

A file will be maintained onsite that includes initial HAZWOPER training certificates (or copy) and up-to-date refresher certificates for all employees involved in field activities. Employees who are unsure that their certificates are onsite shall bring copies with them and present them to the site health and safety officer (SHSO) before beginning field work. Personnel failing to meet or abide by the criteria established in the CHASP and ZHASP shall be restricted from entering work areas.

Subcontractors, DOD oversight personnel, and other site visitors must provide the site supervisor or SHSO documentation showing their HAZWOPER training is current, and must agree to comply with this CHASP, the corresponding ZHASP, or equivalent health and safety requirements prior to site entry. Personnel failing to meet or abide by the provisions of the CHASP, ZHASP, or equivalent shall be restricted from entering work areas.

The SHSO may suspend site work and may instruct personnel to evacuate the area. Examples of situations when this may happen are:

- Severe weather conditions such as thunder, lightening, tornado warnings in the area, or extreme winter conditions.
- Site conditions have changed, for whatever reason, such that the ZHASP does not adequately address the current situation.
- Safety precautions being used are inadequate for the situation.
- Personnel including E/A&H, subcontractors, visitors, or DOD are or may be exposed to an immediate health hazard.
- Fire, explosion, and/or emergency situation in the work area or in the vicinity of the work area.

2.3 Site History and Description

The ZHASP shall contain a brief review of the site's history and existing site data as they pertain to potential site health and safety hazards.

3.0 SITE ACTIVITIES

Field activities to be conducted as part of this RFI are described in the E/A&H *Comprehensive Sampling and Analysis Plan* (CSAP). Types of activities include: drilling (primarily outside, however, some drilling is likely to be done inside buildings); excavating test pits; equipment decontamination; well installation and development; hand augering; and collecting soil, sediment, groundwater, and surface water samples. Specific health and safety procedures associated with specific activities, hazards, and/or sites are addressed in the appropriate ZHASP.

The site supervisor will manage the day-to-day field operations. This includes assigning field staff to specific work tasks and coordinating logistical support. The site supervisor has the authority to suspend or postpone specific field operations if he or she believes worker health and safety concerns have not been adequately addressed.

Certain site activities present a level of hazard that must be dealt with case by case. These activities are neither covered by this CHASP nor by a ZHASP. Examples of such activities are: confined space entry; moving or sampling unknown drums or containers; and entering excavations, trenches, or test pits that are more than 3 feet deep. Should the project manager or site supervisor deem it necessary to perform such activities, they are responsible for contacting the project health and safety officer and requesting an addendum to the ZHASP. The addendum shall specify the training requirements and health and safety procedures necessary for undertaking that activity. These activities are prohibited until the ZHASP addendum is reviewed, accepted, and implemented.

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4.0 CHEMICAL HAZARDS

The ZHASP, and the site-specific sections within the ZHASP shall be designed to protect workers from chemical hazards or radioactive mixed waste as a known or suspected to be present at that specific location. The following information will be included:

- A map displaying the locations of planned work areas within the site.
- The expected site-specific contaminants of concern and the (suspected) magnitude and scope of the situation.
- Decontamination procedures.
- A material safety data sheet (MSDS) for contaminants known or suspected of being present.

Information about known or suspected site contaminants will be summarized in the ZHASP, including a review of existing site data, a list of more significant symptoms of acute and chronic exposure to these contaminants, their carcinogenicity, and OSHA permissible exposure limits (PELs). A table of exposure guidelines will be provided for each site. Information in this table will include odor thresholds, OSHA PELs, American Conference of Governmental Industrial Hygienists threshold limit values (ACGIH TLVs), National Institute of Occupational Safety and Health recommended exposure limits (NIOSH RELs), autoignition temperatures, and flammability ranges for each compound known or suspected to be present at significant concentrations. MSDSs for these materials will be included in an appendix of the ZHASP.

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5.0 PHYSICAL AND BIOLOGICAL HAZARDS

5.1 Physical Hazards

Field personnel should be aware of and act to minimize dangers associated with physical hazards typically encountered during environmental investigations. These hazards include heat-related illnesses, uneven terrain, slippery surfaces, lifting, and use of heavy equipment. Electrical lines may be either above or below ground, and underground gas lines may be present. A post-hole digger may be used to penetrate the top 4 feet of soil. This minimizes the potential for damaging underground utilities. Before initiating drilling activities, drilling locations must be cleared by the NAVBASE Works Department (PWD).

Heavy equipment and drill rig operations will adhere to the procedures outlined in Appendix B, *Drilling Safety Guide*, provided in this plan. Personnel conducting drill rig operations must keep clear of all moving parts. To prevent entanglement with the drill rig, loose clothing is prohibited.

The site supervisor and SHSO shall be aware of the potential for heat stress and other weather-related illnesses (see Section 6.5), and shall implement appropriate work regimens to minimize the likelihood of field personnel becoming ill.

Personnel will walk at all times. Running greatly increases the probability of slips, trips, and falls.

When working in wooded areas where lyme disease is a concern, workers should wear long-sleeved shirts and tape their overalls to their boots or, if not in coveralls, tuck their pants into their socks.

5.2 Procedures For Working In Areas Where Poisonous Snakes May Be Present

Everyone that spends much time outdoors in "snake habitat" areas (areas where poisonous snakes are likely to live or feed) should know what to do to avoid snakes and what not to do when they see a snake. While snake bites are a rarity and in many states there has not been a snake bite fatality for decades, snake bites may still occur. Here are a few brief preventative measures.

Do

- Treat all snakes as poisonous, unless you are familiar enough with snakes to know that the one encountered is not poisonous.
- Wear protective clothing. Snake chaps are best, although not quite as protective, rubber or knee-high leather boots are also helpful.
- Watch where you put your hands and feet when you are in snake habitat. Stay on paths or trails when able, and watch where you walk at all times.
- Be familiar with the venomous snakes of the area where you are. Look for key features such as a diamond shaped head or pits on the side of head just below and in front of eyes. (Do not get closer to the snake to observe these characteristics.) Learn to recognize the various kinds on sight. Also learn to recognize the "mimics" the nonvenomous snakes that resemble the dangerous ones. See attached pictures.
- If you see a snake, make some noise from a safe distance and allow the snake a chance to leave. Also, you can move around the snake yielding a wide berth to the snake or you can retreat and find another path.
- If you are bitten by a snake, get to the nearest hospital or medical facility as soon as possible. It is best to have someone drive you.
- If you are with someone who is bitten by a snake, immobilize the limb and carry the person to your car, if able to do so. Urge him or her to keep calm and point out that the possibility of a fatality is virtually zero.
- Phone ahead to the hospital (Charleston Naval Hospital 743-7000). This will give the attending physician time to prepare and to call the poison information center for advice,

if needed. (According to one doctor the most effective snake bite first aid kit consists of car keys and some coins with which to call a hospital.)

Do Not

- Do not thrust hands under rock ledges, logs, or stumps that may harbor serpents.
- Do not panic when you encounter a snake, stay calm and try to determine if it is poisonous or not. Remember, that the snake may be as surprised as you are, and is certainly as scared.
- Do not corner or trap a snake, leave the snake a safe exit way, most times they will quickly leave.
- Do not do anything to provoke or agitate a snake.

Poisonous Snakes of Charleston, South Carolina

VIPERS: Family Viperidae

All dangerously poisonous serpents except the Coral Snake belong to this group. The Copperhead, Cottonmouth, and Rattlesnake are members.

Pit Vipers: Subfamily Crotalinae

The subfamily name is derived from the deep facial pit on each side of the head situated a little below midway between eye and nostril. The pit is a sensory organ that helps the snake aim in striking at warm-blooded prey. Any serpent with such a pit is poisonous. Don't approach live ones in the field close enough to see the pit.

*** Northern Copperhead** ***Agkistrodon contortrix mokasen***

ID: 24-36 in. The Copperhead gets its name from the coppery-red head and an hourglass pattern. Viewed from above, the dark chestnut crossbands are wide on the sides and narrow at the center of the back. Small dark spots are frequently present between crossbands, with dark, rounded spots along the sides of the belly.

Natural camouflage renders it inconspicuous. Normally a quiet, almost lethargic snake, the Northern Copperhead is content to lie motionless or beat a dignified retreat. Once aroused, it strikes vigorously and may rapidly vibrate the tail. Rocky, wooded hillsides and mountainous areas are favorite habitats, along with abandoned rotting slabs and sawdust piles.

Similar species:

1. In Milk Snakes the large dorsal markings are wide at center of back; belly markings are black and squarish.
2. Hognose Snakes, besides having turned-up snouts, hiss and flatten their heads and necks.
3. Water Snakes seldom wander far from water and retreat into it when alarmed; their scales are strongly keeled.
4. In Fox Snakes, the markings consist of a series of large dark blotches flanked by a series of smaller blotches on each side.

*** Southern Copperhead** ***Agkistrodon contortrix contortrix***

ID: 24-36 in. The Southern Copperhead is a paler, pinker counterpart of the Northern Copperhead. The dark markings are quite narrow across the back, giving the hourglass a more waspwaist appearance than in the northern race. Very often, they are broken at middorsum, the two halves failing to meet.

This is mainly a snake of the lowlands, of low ground near swamps and cypress-bordered streams, but it also ascends into hilly regions.

Similar species: Baby Cottonmouths have a broad dark band through the eyes, and their body hues consist largely of dark browns.

*** Eastern Cottonmouth** ***Agkistrodon piscivorus***

ID: 30-48 in. This large, semiaquatic snake is olive, brown, or black above, and has a lighter belly. It has crossbands with dark, more or less distinct borders; centers of crossbands often invaded by lighter ground color.

Beware of any semiaquatic serpent within the range of the Cottonmouths. These very dangerous snakes closely resemble several of the nonpoisonous Water Snakes (***Nerodia***) and they are difficult to differentiate in the field. Behavior offers some of the best clues. Cottonmouths often stand their ground or crawl slowly away. Water Snakes usually flee quickly or drop with a splash into the water. Cottonmouths vibrate tails when excited; Water Snakes do not. A thoroughly aroused Cottonmouth throws its head upward and backward and holds its mouth wide open, revealing a whitish interior—origin of the name Cottonmouth.

This is a snake of southern lowlands, denizen of swamps, lakes, rivers, and of rice field ditches. It suns itself on branches, logs, or stones at the water's edge and sometimes wanders away from its normal habitat in pursuit of food.

Similar species:

1. The nonpoisonous Water Snakes (***Nerodia***) have divided anal plates, a double row of scales under the tail, and no facial pits.
2. Young Copperheads are more reddish than baby Cottonmouths, and they have a narrow dark line through the eyes.

Note: The representative pictures for this species are of the Western and Florida species, not the Eastern species that are found in Charleston. The Eastern species will have more green between crossbands and no defined black strip on its head. Other than color, all three species look very similar.

*** Carolina Pygmy Rattlesnake** ***Sistrurus miliarius***

ID: 15-21 in. The tiny rattle, sounding like the buzz of an insect, is scarcely audible more than a few feet away. In this race the markings are clear-cut, there are one or two rows of dark lateral spots, and the center is cream-colored, moderately flecked with brown or grey. Dorsal coloration is brown or light grey; a middorsal russet stripe is found in many specimens.

Behavior varies, depending on such factors as temperature and temperament. Some strike furiously; others are lethargic and do not even sound the rattle. This snake is common in longleaf pine-scrub oak and longleaf loblolly pine flatwood areas on the Atlantic Coastal Plains.

*** Timber Rattlesnake** ***Crotalus horridus***

ID: 36-60 in. There are four major color variations:

(a) *Yellow variation*: black or dark brown crossbands on a ground color of yellow or brown; the crossbands, which may be V-shaped, break up anteriorly to form a row of dark spots down the back plus a row along each side of body; uplands of the Northeast.

(b) *Western variation*: black or dark brown crossbands on a ground color of grey, yellow, tan, or brown; a broad rusty middorsal stripe present; dark stripe present behind eye; generally found west of the Mississippi River, from the Ozarks northward.

(c) *Southern variation*: black crossbands on a pinkish buff, pale grey, or tan ground color, with a broad, reddish middorsal stripe that splits the crossbands in half on the forward part of the body; broad dark stripe present behind eye; lowlands of the South.

(d) *Black* (melanistic) *variation*: a heavy stippling of black or very dark brown that hides much of the lighter pigment; completely black specimens are not unusual; uplands of the Northeast. In the South, it inhabits the lowlands, favoring cane thickets and swampland.

Similar species:

1. Massasaugas and Pygmy Rattlesnakes have nine plates on the crown of the head instead of numerous small scales, however, Diamondback Rattlesnakes have diamond markings instead of dark crossbands.

*** Eastern Diamondback Rattlesnake** ***Crotalus adamanteus***

ID: 33-72 in. The diamonds, dark brown or black color, are strongly outlined by a row of cream-colored or yellowish scales. Ground color is olive, brown, or almost black. Only rattler within its range with two prominent light lines on face and vertical light lines on snout.

The Eastern Diamondback Rattlesnake is at home in the palmetto flatwoods and dry pinelands of the South. On occasion, the rattlesnake will venture into salt water. Individual dispositions vary. Some snakes will permit close approach without making a sound, whereas others, completely concealed in vegetation, will rattle when dogs or people are 20 or 30 feet away. Many will stand their ground, but when hard pressed they back away, rattling vigorously but still facing the intruder. Frequently they take refuge in burrows of gopher tortoises, in holes beneath stumps, etc.

CORAL SNAKES: Family Elapidae

These snakes are dangerously venomous. Although their small mouths and relatively short fangs make it difficult for them to bite most parts of the human anatomy (fingers or toes are vulnerable), their venoms are potent.

*** Eastern Coral Snake** ***Micrurus fulvius***

ID: 20-30 in. A shiny, "candystick" snake whose colored rings completely encircle the body. Red and Yellow rings touch. The end of the snout is black, followed by a yellow band across the head. The black ring on the neck does not touch the parietal scutes. Red

rings dotted or spotted with black, the dark markings often concentrated into a pair of fairly large black spots in each red ring. Hint: Remember, "When red touches yellow, it will kill a fellow."

Coral Snakes are usually secretive, but when they prowl, it is normally by day, especially in early morning. Sometimes they may be discovered hiding under leaves of debris, in logs, palmetto stumps, etc. Habitats vary from well-drained pine woods and open, dry, or sandy areas, to moister environments such as ponds and lake borders and in the (often) dense and jungly growths of hardwoods. When suddenly restrained, a Coral Snake may thrust its tail upward with the tip curled into a ball that may momentarily be mistaken for the head.

Similar species: The venomous Coral Snakes are well-imitated serpents. Several harmless snakes also sport rings (or near-rings) of red, black, and yellow (or white). In all of them, however, black separates red from yellow. Think of a traffic light; red means ***stop***, and yellow means ***caution***. If these two warning colors touch on the snake's body, it is poisonous. "Mimics" include the Scarlet Snake, Scarlet King Snake, and several of the Milk Snakes.

6.0 EMPLOYEE PROTECTION

Employee protection for this project includes: work limitations, PPE, personnel and equipment decontamination procedures, procedures for working in extreme weather conditions, standard safe work practices, and general rules of conduct.

6.1 Work Limitations

Personnel shall not conduct prohibited activities (see Sections 3.0, and 6.6). Site activities will be conducted during daylight only. Personnel scheduled for these activities shall meet the training requirements specified in 29 CFR 1910.120(e); this includes initial health and safety training, annual refresher training, and supplemental training required for onsite supervisors.

Personnel with medical restrictions, whether suggested by their personal physician or the E/A&H company physician, shall abide by those restrictions. If asked to perform a task and doing so would violate a medical restriction, personnel shall inform the site supervisor that they are not permitted to perform the requested task.

6.2 Selection of Personal Protective Equipment

It is important to select a PPE ensemble that not only protects against the known and foreseeable site hazards but also provides some extra margin of safety so that workers also are protected from some unexpected conditions. PPE ensembles will be selected based on the type and concentration of expected contaminants, work activities to be performed, and their ability to prevent contaminants from reaching target organs. To the extent that site contaminants and their concentrations are unknown, and other relevant conditions and factors are unknown, uncertain, or not clearly identifiable, the determination of the required PPE is more subjective. In these cases, the project health and safety officer (PHSO) must base his/her decision on fundamental health and safety principles and experience.

Within the ZHASP, the PHSO will specify the required level of PPE, however these requirements are subject to change as site information changes. The project manager or SHSO may request changing or modifying the required PPE specified in the ZHASP, however, the decision to change PPE requirements or to upgrade or downgrade levels of PPE shall be made by the PHSO.

At most sites, invasive field activities will be initiated in Modified Level D protection. Modified Level D protection was selected because the concentration of contamination encountered at most sites is expected to be low. In cases where site conditions indicate Modified Level D is inappropriate, a different level of PPE will be specified. The level of PPE to be used at a site will be specified in that site's section of the ZHASP.

Table 6-1 outlines the criteria for selecting the appropriate level of protection and lists the PPE associated with each level of protection. When establishing levels of protection, some PPE is optional. Table 6-1 lists required and optional equipment.

Almost all invasive activities will be conducted in either Modified Level D or Level C protection. Modified Level D protection consists of chemical-resistant coveralls, typically Tyvek™; hard hat; appropriate chemical-resistant gloves, vinyl or nitrile; eye protection; and chemical-resistant, steel-toed and steel-shanked boots. Level C protection is essentially the same as Modified Level D except cartridge respirators are added. When cartridge respirators are required, E/A&H's policy is to use full-face respirators.

Equipment listed as optional may in fact be required for a project or its aspects. Generally, the PHSO decides if optional equipment shall be required for a particular project. For example, disposable chemical-resistant outer boots are optional in Level B, C, and Modified D. Whereas E/A&H generally does not dedicate safety boots to a project, the PHSO typically requires using

Table 6-1
Level of Protection and Criteria

Level of Protection	Criteria for Use	Equipment
Level A	• When atmospheres are "immediately dangerous to life and health" (IDLH in the NIOSH/OSHA Pocket Guide to Chemical Hazards or other guides.) • When known atmospheres or potential situations exist that could affect the skin or eyes or be absorbed into the body through these surfaces. Consult standard references to obtain concentrations hazardous to skin, eyes, or mucous membranes. • Potential situations include those where immersion may occur, vapors may be generated, or splashing may occur through site activities. • Where atmospheres are oxygen deficient. • When the type(s) and or potential concentration of toxic substances are not known.	• Full-face, self-contained breathing apparatus (SCBA) or supplied air respirator with a positive-pressure regulator and an escape bottle • Fully encapsulating chemical protective suit • Chemical-resistant inner and outer gloves • Steel-toe and steel-shank chemical-resistant boots • Hard hat (as required by PHSO) under suit • Two-way radios worn inside suit • Optional: disposable chemical-resistant protective suit, gloves, and boots (to protect the Level A suit), cooling vest
Level B	• When respiratory protection is warranted and cartridge respirators are not appropriate. Examples of these conditions are: - when work area may contain less than 19.5 percent oxygen, - when expected contaminants do not have appropriate warning properties e.g. vinyl chloride, or - when cartridges are not available to protect against all contaminants of concern. • Site contamination is unknown or inadequately characterized. • Hazards associated with limited dermal exposure are not significant.	• Chemical-resistant clothes, coveralls • Full-face, SCBA or supplied air respirator with a positive-pressure regulator and an escape bottle • Hard hat (as required by PHSO) • Chemical-resistant outer and inner gloves • Steel-toe and steel-shank boots • Chemical-resistant outer boots • Optional: cooling vest, disposable chemical-resistant outer boots

Table 6-1
Level of Protection and Criteria

Level of Protection	Criteria for Use	Equipment
Level C	• When respiratory protection is warranted and cartridge respirators are appropriate. • When PID readings exceed the Action Level. • When air monitoring indicates airborne concentration of a chemical is 50 percent or more of the PEL or TLV • And the work area contains at least 19.5 percent oxygen.	• Chemical-resistant coveralls • Full-face, air-purifying respirator equipped with cartridges suitable for the hazard • Hard hat • Chemical-resistant outer and inner gloves • Steel-toe and steel-shank boots • Disposable chemical-resistant outer boots
Modified Level D	• When chemical contamination is known or expected to be present, yet inhalation risk is low and respiratory protection is not required. • Site contaminants may be absorbed through the skin. • The "default level" of PPE required when the ZHASP does not specify another level of PPE. • And the work area has at least 19.5 percent oxygen.	• Chemical-resistant coveralls • Chemical-resistant outer gloves; inner gloves or glove liners, optional • Steel-toe and steel-shank boots • Hard hat • Safety glasses with side shields or safety goggles • Optional: disposable chemical-resistant outer boots
Level D	• When minimal or no chemical contamination is expected. • When ZHASP specifies Level D protection is adequate. • And the work area has at least 19.5 percent oxygen.	• Inner gloves or chemical-resistant gloves needed to handle soil or water samples • Steel-toe and steel-shank boots • Hard hat • Safety glasses with side shields or safety goggles • Optional: coveralls and disposable outer boots • Work clothes

disposable chemical-resistant outer boots. These are required in order to protect the worker's safety boots and to reduce the likelihood of spreading contamination from a contaminated area to a non-contaminated area.

6.3 Air Monitoring

Previous site work indicates workers may be exposed to numerous chemicals, including volatile organic compounds (VOAs), halogenated compounds, metals, PCBs, pesticides, PAHs, and combustible gases/vapors.

Air will be monitored using a photoionization detector (PID) and/or other appropriate sampling equipment before beginning field activities at each new EZ and during ground-disturbing activities. If high concentration levels of VOA are detected downhole or downwind, colorimetric detector tubes and/or other sampling media may be used to identify and approximate the concentrations of these compounds.

6.3.1 Action Level and Ceiling Concentration

Each site shall have a designated action level (AL) and ceiling concentration. For this project, the AL is defined as the PID reading in the breathing zone above which respiratory protection must be upgraded; chemical protective clothing also may be upgraded. The AL and the upgrade will be defined in the ZHASP. To exceed the AL, PID readings should be sustainable. Readings should remain above the AL for at least one or two minutes at a time. Readings elevated for only a few seconds every 15 or 20 minutes do not exceed the AL and do not require workers to upgrade their level of PPE. The AL will be determined site by site basis and will be designated in the ZHASP. The same AL may apply throughout the entire Zone or vary from site to site within the zone. If a site is to have an AL different than the rest of the zone it will be presented in the site-specific section of the ZHASP.

PPE will be upgraded to at least Level C if airborne concentrations exceed the AL or if concentrations of any contaminant exceed 50 percent of the OSHA PEL in the breathing zone. The ceiling concentration is defined as the maximum allowable PID reading in the breathing zone regardless of PPE. If PID readings exceed this value, the site supervisor shall instruct field personnel to stop work, shut down operating equipment, and leave the work area. The ceiling concentration will be determined site by site basis and will be specified in the ZHASP.

Field activities shall stop if breathing zone levels exceed the AL, reach 50 percent of a compound's PEL or TLV, or site conditions indicate additional health and safety precautions are needed. Field staff shall notify the site supervisor of the situation and he/she shall contact both the project manager and the PHSO. The PHSO will be responsible for reassessing the hazards and prescribing revised health and safety requirements as necessary, including the use of a respiratory protection, upgrading protective clothing, revising work schedules, and revising decontamination procedures. (Typically, PPE will be upgraded to Level C assuming that cartridge respirators are appropriate, otherwise Level B.) Work shall not proceed until breathing zone concentrations return to background concentrations and it is reasonably anticipated that breathing zone samples will stay approximately at background concentrations, or the chemical constituent(s) are identified and appropriate PPE is donned. Field monitoring values will be recorded in a field logbook and copies must be posted for field personnel review.

6.3.2 Combustible Gas Indicator

Downhole combustible gas indicator (CGI) readings will be collected continuously during all soil-disturbing operations. Field activities immediately will cease if downhole readings exceed 10 percent lower explosive limit (LEL). If CGI readings do not subside, the area will be carefully investigated and mapped. Operations may not proceed until readings are below 10 percent LEL. The area will be immediately evacuated and the situation re-evaluated to determine how to proceed.

6.3.3 Equipment Calibration

PIDs, CGIs, and other monitoring equipment shall be calibrated daily or their proper function verified before being used. The CGI will be field calibrated to measure flammable gases relative to a 23 percent (LEL) methane standard. A CGI will be used when field staff are drilling or installing wells. Throughout the day, this equipment shall be periodically checked to ensure it is working properly. A final calibration shall be conducted at the end of the work day, at which time each instrument will be checked to ensure it is free from surface contamination. Field staff shall record in their field notebooks the fact that they conducted these calibrations and checks and note whether the equipment was functioning properly. Equipment responding more than 10 percent plus or minus from known standards shall be considered malfunctioning. Malfunctioning equipment should be brought to the attention of the site supervisor or SHSO, who will arrange for repair and/or replacement.

6.4 Personnel and Equipment Decontamination

As needed, a CRZ will be established adjacent to an EZ established for invasive activities, and will include stations for decontaminating personnel, PPE, and hand tools. Typically, a portion of the CRZ will be covered with sheets of 6 millimeter (mm) polyethylene (generally, an area 20 feet by 20 feet is sufficient) with specific stations to accommodate removing and disposing of protective clothing, boot covers, gloves, and respiratory protection.

Prior to initiating field work at a site it shall be screened for potential radiological contamination in accordance with Section 10.7 of the CSAP. For field work to continue, radiation levels must be less than 50 microroentgens per hour (uR/hr). If measured levels are less than 50 uR/hr, work may proceed as planned, radiological screening will continue to be conducted in accordance with the screening procedures specified in Section 10.7 and in the appropriate sections of the ZHASP. (Section numbers may vary between ZAHSPs, hence no specific Section Reference is provided).

Whenever radiation levels exceed 50 uR/hr, follow the detailed procedures established in the ZHASP (Sections entitled Employee Protection and Personnel and Equipment Decontamination). At a minimum:

- Potentially contaminated persons and equipment must be decontaminated.
- Personnel shall be scanned with both an alpha and a beta-gamma detector before leaving the site.
- Equipment shall be scanned with both an alpha and a beta-gamma detector before moving it from site.

Heavy equipment and field equipment that cannot adequately be decontaminated in the CRZ may be decontaminated on a more centrally located decontamination pad. Table 6-2 lists equipment that may be convenient to have onsite in order to decontaminate heavy equipment and vehicles; this table also explains how this equipment may be used. Details on how the decontamination pad will be laid out and how waste and runoff will be collected and disposed is discussed in the Work Plan.

Often equipment may be adequately decontaminated using a soapy wash solution and following specified rinsing procedures. Normally equipment decontamination will be completed in Level D or Modified D PPE. In the event of inclement weather (e.g., lightning) or an emergency requiring immediate evacuation, contaminated equipment will be bagged or wrapped and taped in 6 mm polyethylene sheeting and tagged as "contaminated" for later decontamination. Respirators not only need to be decontaminated and cleaned between uses, but also need to be sanitized. Alcohol swabs generally are sufficient.

Table 6-2
Equipment Recommended for Decontaminating Heavy Equipment and Vehicles

- Tanks or drums to be used for storing collected wash and rinse solutions, alternatively, equipment to treat collected wash and rinse solutions may be substituted.
- Pumps and filters, as needed, to collect wash and rinsate solutions.
- Pressurized steam sprayers for steam-cleaning equipment.
- Long-handled brushes for general cleaning of exterior surfaces. Also shovels and other equipment may be used to dislodge caked-on contaminated mud on the undercarriage or in the tires.
- Wash solutions, selected for their ability to remove (dissolve, desorb, etc.) contaminants
- Rinse solutions, selected for their ability to remove contaminants and wash solutions.
- Pressurized sprayers for washing and rinsing, particularly hard-to-reach areas.
- Clean buckets that can contain cleaning and rinsing solutions.
- Brooms and brushes that can be used to clean the interior, operator areas of vehicles and equipment.

Figure 6-1 shows one method of laying out an acceptable decontamination area for Level B PPE. There are numerous ways to lay out decontamination areas. Decontamination areas for Level C and Modified D PPE should be based on this concept of decontamination, but can be scaled back in accordance with the decontamination needs of the specific site and level of PPE. As a general rule, people working in the CRZ, assisting in decontaminating workers leaving the EZ, shall be outfitted in PPE that is one protection level below what the exiting workers are using. For example, if workers leave the EZ in Level C, personnel in the CRZ should be in Modified D.

6.4.1 Full Decontamination Procedures of Level B, C, and Modified D

Workers shall use the following cleaning and decontamination procedures when exiting the EZ. These procedures should be followed when workers are leaving the area for lunch, at the end

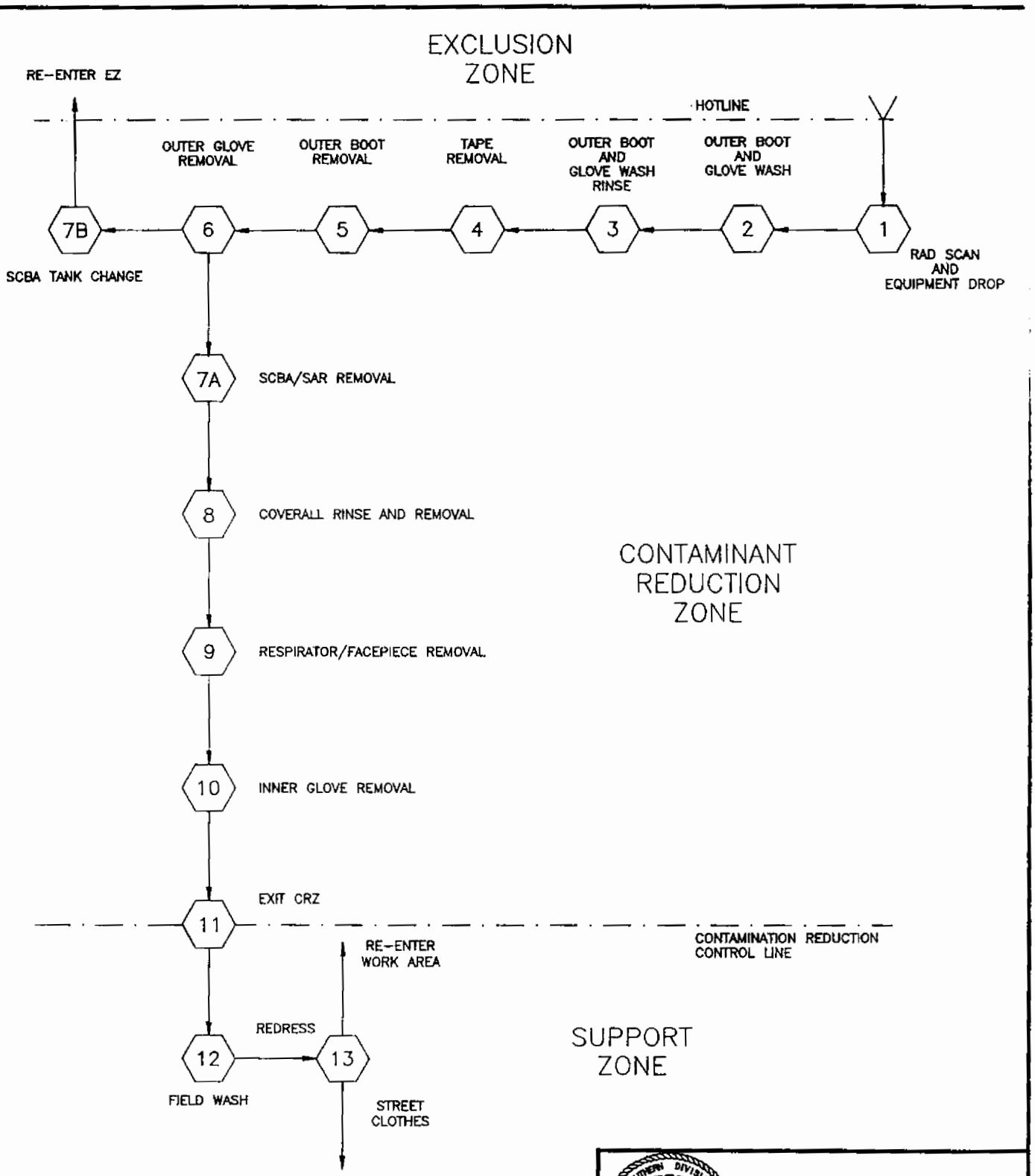
of their shift, or when work is completed for an EZ. Procedures for rest breaks, changing self-contained breathing apparatus (SCBA) tanks, and cartridges are described in Section 6.4.2. Not all steps apply to every situation; follow applicable procedures. Decontamination procedures shall start at the EZ/CRZ interface and continue away from the EZ toward the SZ.

Full Decontamination

1. Radiation monitoring. If radioactive monitoring is in effect, scan hands, feet, and equipment with radiation detector.
2. Equipment drop. Deposit used equipment onto plastic drop cloths or into a plastic-lined tub. All gross contamination should be removed here; fine cleaning and equipment decontamination may be completed here or elsewhere. Before moving equipment that is still contaminated, it must be wrapped and taped.
3. Outer boot and glove wash. Wash/remove gross contamination from outer boots, outer gloves, SCBA and/or airline equipment.
4. Tape removal. Remove tape from ankles and wrists and dispose of in plastic-lined drum.
5. Outer boot removal. Remove outer boots; disposable outer boots may be disposed of in the same waste container used in Step 4. Non-disposable boots need a thorough cleaning before they can be removed from the site. (If using non-disposable boots, it is preferable to have them dedicated to the project.)
6. Outer glove removal. Remove and dispose outer gloves; gloves may be disposed of in the same waste container as used in Step 4.
7. SCBA and supplied-air respirator (SAR) removal. For Level B*.

   SCBA — With buddy or other site worker, remove backpack, remove face piece, and shut off air flow.

   Airline — With buddy or other site worker, remove harness and escape bottle, remove face piece, and shut off air flow.



FINAL RFI CHASP
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 6-1
FULL DECONTAMINATION LAYOUT
LEVEL B PROTECTION

DWG DATE: 08/08/94 | DWG NAME: 29FDLLP

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* When coveralls are significantly contaminated, leave the respirator face piece on, disconnect the air hose just downstream of the regulator, turn off the flow of air, remove the backpack or equipment harness, and leave the face piece in place. Remove the face piece in Step 9.

8. Coverall removal. Rinse coveralls, if needed, remove, and dispose of them, again the same drum may be used as in Step 4. Non-disposable coveralls shall be double-bagged with the outer bag clearly labeled "contaminated."
9. Respirator removal. Remove respirator (or face piece of Level B equipment, if it is still being worn). Dispose of spent cartridges, clean, disinfect, dry, and properly store respirator or face piece.
10. Inner glove removal. Remove and dispose inner gloves.
11. Exit area. Exit the CRZ via the SZ.
12. Field wash. Wash and rinse hands and face.
13. Redress. Redress into appropriate PPE for re-entry or change into street clothes.

Note: — All wastes (soil and water) generated during personal decontamination will be collected in 55-gallon drums. The drums will be labeled by E/A&H personnel; final disposal will be done by the Navy.

— Hard hats and eye protection should be washed with a soap and water solution at each work day's end.

6.4.2 Partial Decontamination Procedures

To change a respirator cartridge or SCBA tank, follow these procedures:

1. Radiation monitoring. If radioactive monitoring is in effect, scan hands, feet, and equipment with radiation detector.
2. Outer boot and glove wash. Wash outer boots and gloves. Wash/remove gross contamination from SCBA and/or airline equipment.

3. Tape removal. Remove tape from ankles and wrists and dispose of it in a plastic-lined drum.

3A. Face piece removal. Disconnect face piece and air hose just downstream of regulator. Face piece may remain in place, or be removed and cleaned. Remove the spent tank from the backpack and replace it with a full tank. Connect air hose and turn on air.

3B. Respirator removal. Remove respirator, remove used cartridges, clean and disinfect respirator, install new cartridges, and don respirator.

4. Respirator check. Check to make sure that respirator still seals properly to your face.

5. Don clean PPE. Put on clean outer gloves, tape wrists (as applicable), and re-enter EZ.

When taking a rest break, the following procedures should be followed:

1. Radiation monitoring. If radioactive monitoring is in effect, scan hands, feet, and equipment with radiation detector.

2. Outer boot and glove wash. Wash outer boots and gloves. Wash/remove gross contamination from SCBA and/or airline equipment.

3. Tape removal. Remove tape from ankles and wrists and dispose of it in a plastic-lined drum.

4. Respirator removal. Remove SCBA unit, airline harness, or respirator, and place in a clean area. Plastic sheeting may be needed.

5. Coverall removal. Remove outerwear if it is ripped or significantly contaminated. In hot weather at least unzip and pull down upper half of coveralls.

6. Inner glove removal. Remove and dispose of inner gloves.

7. Wash. Wash and rinse hands and face at the field wash station.

8. Rest break. Take rest break, remember to drink plenty of water, Gatorade™, or similar beverage.

9. Don inner gloves. Put on inner gloves.

10. Don PPE. Don coveralls, outer boots, and outer gloves. Tape wrists and ankles (as needed), and re-enter the EZ.

Decontamination procedures, based on Level D protection, will consist of the following:

- Brushing heavily soiled boots and rinsing outer gloves and boots with soap and water.
- Removing gloves and depositing them in a trash container.
- Disposing of gloves and other disposable PPE in a trash container.
- Washing hands and face, and preferably showering as soon as practical.

6.4.3 Closure of the Decontamination Station

All disposable clothing and plastic sheeting used during activities at sites with Level D through Level C will be double-bagged and disposed of in a refuse container. Decontamination and rinse solutions and disposable PPE from Level B sites will be placed in a labeled 55-gallon drum (separate solids and liquids) for later analysis and disposal. All washtubs, pails, buckets, etc., will be washed and rinsed at the end of each workday.

6.5 Procedures and Equipment for Extreme Weather Conditions

The summer months in Charleston can be hot with high relative humidity, the winter months can have cold spells also with high relative humidity. Therefore, heat and cold stress are a concern. Adverse weather conditions are important considerations in planning and conducting site operations. Extremes in hot and cold weather can cause illness, injury, physical discomfort, fatigue, reduced mental clarity, and loss of efficiency.

6.5.1 Exposure to Hot Weather

Heat stress or heat-related illness occurs when the combined metabolic and environmental heat to which an individual is exposed exceeds the body's ability to cool. The manifestations of heat stress are the adjustments an individual makes in response to increased body temperature. The three most important categories of heat-induced illness are: heat exhaustion, heat cramps, and heat stroke. These disorders can occur when the normal responses to increased internal heating are not adequate to meet the needs for heat loss or when the body's temperature-regulating mechanisms fail to function properly.

Due to impervious protective clothing, heat stress can result even when temperatures are moderate. Various levels of personal protection may require wearing low-permeability disposable suits, gloves, and boots. These prevent cooling and create discomfort by increasing perspiration and elevating body temperature (heat stress).

Heat exhaustion is a state of collapse brought about by an insufficient blood supply to the cerebral cortex of the brain. The cause of heat exhaustion is low blood pressure created by inadequate heart output and widespread expansion of blood vessels.

Heat Exhaustion Factors — Factors that can lead to heat exhaustion are as follows:

- Increased expansion of blood vessels decreases the circulatory system's capacity to meet the demands for releasing heat generated by ambient conditions, exercise, and metabolic activities.
- Due to the prolonged sweating, the body loses salt and water.
- Reduced blood volume due to lack of physical training, infection, intoxication (from industrial contaminants as well as from drinking alcohol), or heart failure.

Heat Exhaustion Symptoms — The symptoms include extreme weakness, fatigue, dizziness, nausea, and headache. More severe cases also may involve vomiting and unconsciousness. The skin becomes clammy and moist, the complexion pale, and the oral temperature stays normal or low but the rectal temperature is usually elevated (99.5°F to 101.3°F). One sign of heat exhaustion is dilated pupils. Workers who are unacclimated run the highest risk.

Heat Exhaustion Treatment — In most cases, heat exhaustion treatment is fairly simple. The victim is moved to a cool place. Remove as much clothing from victim as practical and elevate his feet. If the victim is unconscious, seek medical assistance. Mild cases may experience immediate recovery; however, more severe cases may require several days care. No permanent effects have been reported.

Prevention — Unacclimated people in particular need to be careful not to over-exert themselves. Drink fluids to keep the body hydrated; liquids that also can replenish electrolytes are preferred. Gatorade™ and Quench™ are examples of two products that replace electrolytes.

Heat cramps result when the working muscles go into painful spasms. This may occur in people who perspire profusely, even when drinking large quantities of water, if they fail to replace spent electrolytes (salt). The low salt content in the blood causes the cramping. The abdominal muscles, as well as the muscles in the arms and legs, may be affected. The cramps may appear during work or up to several hours later. People on low-sodium diets should consult their physicians and should not be given salt.

Heat Cramp Symptoms — Symptoms of heat cramps include: severe muscle cramps and pain, exhaustion, and stiff abdomen.

Heat Cramp Treatment — Remove victim from hot environment, and replenish lost liquids and electrolytes.

Heat stroke is the most serious of the health problems that arise while working in hot environments. It is caused by the breakdown of the thermo-regulatory system. When this happens, perspiration stops and the body can no longer regulate its own temperature.

Heat Stroke Symptoms — A heat stroke victim may be identified by hot and unusually red or spotted skin. A person's skin may be either dry or wet. The body core temperature can exceed 105°F. Mental confusion, irritability, and chills are common. These are all early warning signs of heat stroke; if the sufferer is not removed from the hot environment at once, more severe symptoms can follow, including unconsciousness, delirium, and convulsions, possibly ending in death.

Heat Stroke Treatment — Heat stroke must be treated as a major medical emergency; medical assistance must be summoned immediately.

Additional treatment:

- First aid must be administered.
- Individual must be moved to a cool location.
- Help victim remove clothes, as appropriate.
- Individual must be cooled through wetting, fanning, or immersion. Do not overcool or cause the victim to shiver or become chilled.

Use cool, not cold, water. Care should be taken to avoid over-cooling. Treat the victim for shock by having him lie down. Place something under his legs to keep them slightly elevated. Early recognition and treatment of heat stroke are the only means of preventing permanent brain damage or death.

Heat Stroke Prevention

To reduce the potential for heat strokes:

- Drink plenty of fluids (to replace loss through sweating).
- Wear cotton undergarments to act as a wick to absorb moisture.
- Provide adequate shade or shelter for taking rest breaks and cooling off.
- Limit physically demanding activities.

Additional Measures for Extremely Warm Weather:

- Adjust work and rest regimens to prevent workers from overheating.
- Wear cooling devices to aid in ventilation. (Note: the additional weight may impair efficiency.)
- Install portable showers or hose-down facilities to cool clothing and body.

- Shift working hours to early morning and early evening. Avoid the hottest time of the day.
- Frequently rotate crews wearing the protective clothing (if required).
- Rotate tasks by conducting labor-intensive tasks at the coolest times of the day, then switching to other tasks.

6.5.2 Exposure to Cold Weather

People working outdoors in temperatures at or below freezing may experience frostbite or hypothermia. Extreme cold for a short time may severely injure the body. Areas with a high surface area-to-volume ratio, such as fingers, toes, and ears, are the most susceptible.

Two factors influence the development of cold injury: ambient temperature and wind velocity. As a general rule, the greatest incremental increase in wind chill occurs when a wind of 5 mph increases to 10 mph. Additionally, water conducts heat 240 times faster than air, thus on a cold day the body can cool quickly when PPE is removed and a person has wet clothing underneath.

Frostbite is a condition in which the cold forms ice crystals in the cells and tissues, dehydrating protoplasm and killing tissues. At the same time, blood circulation is blocked. Frostbite could lead to gangrene and amputation.

Frostbite damage occurs in several degrees:

- Frost nip, or incipient frostbite, is characterized by sudden whitening of the skin.
- When superficial frostbite occurs, the skin has a waxy or whitish look and is firm to the touch; however, the tissue underneath has retained its resiliency.
- In deep frostbite, the tissues are cold, pale, and solid. In addition to frostbite, other physiological reactions to cold may be experienced. Trench foot, for example, may result from prolonged exposure to low temperatures near, though possibly above, freezing. Walking is very painful. In very severe cases, the flesh dies and the foot may

have to be amputated. Immersion foot is very similar, although it is less severe. Although amputation is unusual, some permanent mobility of the limb may be lost. Blisters may occur around the lips, nostrils, and eyelids.

Chilblain (pernio), an inflammation of the hands and feet caused by exposure to cold and moisture, is characterized by a recurrent localized itching, swelling, and painful inflammation on the fingers, toes, or ears produced by mild frostbite. Advanced cases produce severe spasms, accompanied by pain.

Hypothermia occurs when the body loses heat faster than it can produce it. Initially blood vessels constrict in the hands and feet in an attempt to conserve heat. After the initial reaction, involuntary shivering begins in an attempt to produce more heat.

Temperature is only a relative factor in cases of hyperthermia. Cases of exposure have occurred in temperatures well above freezing. Humidity is a very important factor; higher humidities increase the risk of hypothermia. Moisture on the skin and clothing will allow body heat to escape many times faster than when they are dry.

Hypothermia occurs when the body's core temperature drops below 96°F. When this happens, the affected person becomes exhausted. He may begin to behave irrationally, move more slowly, stumble, and fall. The speech becomes weak and slurred. If these preliminary symptoms are allowed to pass untreated, stupor, collapse, and unconsciousness occur, possibly ending in death.

To reduce effects of cold exposure:

- **Stay dry**. When the temperature drops below 40°F, pace yourself to minimize perspiration; for personnel who expect to perspire, it is prudent to bring a change of clothes.

- **Wear wool.** Many fabrics, when wet, lose up to 90 percent of their insulating value. Wool clothes provide good insulation, are breathable, give off moisture, and retain their insulating properties when wet.
- **Beware of the wind**. A slight breeze carries heat away much faster than still air. Wind drives cold air under and through clothing. Wind refrigerates wet clothes. A rule-of-thumb: Each mile per hour of wind increases the wind chill by 1 to 2 degrees Fahrenheit (°F).
- **Understand cold**. Most hypothermia cases develop in temperatures between 30°F and 50°F. Cold water running down the neck and legs or cold water held against the body by wet clothes causes hypothermia.
- **Have shelter available**. Make adequate dry, warm shelter available.
- **Provide warm drinks**.
- **Never ignore shivering**. Persistent shivering is a clear warning that a person is experiencing cold stress and may be on the verge of hypothermia. Allow for the fact that exposure greatly reduces normal endurance. Understand that warmth generated by physical activity may be the only factor preventing hypothermia, and if a person's activity level drops, his physical condition could deteriorate quickly and substantially.

6.6 Standard Safe Work Practices

- Eating, drinking, chewing gum or tobacco, smoking, or any activity that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated as contaminated, unless authorized by the site health and safety officer.
- Hands and face must be thoroughly washed upon leaving the work area.
- No contact lenses will be worn in work areas while invasive actions are conducted.
- Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.
- Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, leachate, or discolored surfaces, or

lean, sit, or place equipment on drums, containers, or on soil suspected of being contaminated.

- Medicine and alcohol can exacerbate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel on cleanup or response operations where the potential for absorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician. Consumption of alcoholic beverages is prohibited.
- Due to the possible presence of overhead power lines, adequate side and overhead clearance should be maintained to ensure the drill rig boom does not touch or pass close to any overhead lines.
- Due to the possible presence of underground utilities (including electric, natural gas, water, sewer, telephone, etc.), the activity and local utility representatives should be contacted and requested to identify all lines at the ground surface using characteristic spray paint or labeled stakes. A 3-yard buffer zone should be maintained during all subsurface investigations.
- Due to the flammable properties of the potential chemical hazards, all spark or ignition sources should be bonded and/or grounded or mitigated before soil boring advancement or other site activities begin.

6.7 General Rules of Conduct:

- Liquor, firearms, narcotics, tape recorders, and other contraband items are not permitted on the premises.
- Any violation of local, state, or federal laws, or conduct which is outside the generally accepted moral standards of the community is prohibited.
- Violation of the Espionage Act, willfully hindering or limiting production, or sabotage is not permitted.
- Willfully damaging or destroying property, or removing government records is forbidden.

- Misappropriation or unauthorized altering of any government records is forbidden.
- Securing government tools in a personal or contractors tool box is forbidden.
- Gambling in any form, selling tickets or articles, taking orders, soliciting subscriptions, taking up collections, etc. is forbidden.
- Doing personal work in government shop or office, using government property or material for unauthorized purposes, or using government telephones for unnecessary or unauthorized local or long distance telephone calls is forbidden.
- Compliance with posted signs and notices is required.
- Boisterousness and noisy or offensive work habits, abusive language, or any verbal, written, symbolic, or other communicative expression which tends to disrupt the work or morale of others is forbidden.
- Fighting or threatening bodily harm to another is forbidden.
- Defacing any government property is forbidden.
- Wearing shorts of any type and/or offensive logos, pictures, or phrases on clothing is forbidden. Shirts, shoes and pants or slacks, or coverall-type garments will be worn at all times on government property.
- All persons operating motor vehicles will obey all NAVBASE traffic regulations.

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7.0 MEDICAL MONITORING PROGRAM

All E/A&H personnel who enter hazardous waste/spill sites or have the potential for exposure to hazardous materials from these sites must participate in the E/A&H Medical Monitoring Program. The program is conducted by E/A&H's company doctor and is managed by the senior corporate health and safety officer. The program's purpose is to identify pre-existing illnesses or problems that could put an employee at an unacceptable risk when performing what for others may be a routine occupational task. E/A&H maintains the right to exclude certain individuals from particular jobs based on reports from the company doctor.

The medical monitoring program will be reviewed annually to determine its effectiveness. The company doctor has been employed as an independent contractor to provide medical monitoring for E/A&H. The doctor is responsible for the following aspects of the medical monitoring program:

- Selection and quality assurance of medical and laboratory services involved in carrying out the monitoring program.
- Development of a uniform medical record.
- Confidentiality of medical records and information.
- Record retention.
- Employee notification of examination results.
- Determination of content of the medical and biological monitoring programs.
- Record review and correlation between potential exposure and effect.
- Monitoring job-related illness and injury for each employee.

7.1 Preplacement Examinations

Each E/A&H employee will be given a preplacement examination to identify pre-existing illnesses or problems that are, or could lead to, other medical complications if exposed to chemicals at concentrations that would not impact "healthy" employees, to assure each employee

can safely use negative-pressure respirators, and to develop a baseline database to help evaluate exposure-related events detected during periodic medical monitoring. Data accumulation will include variables such as age, sex, race, smoking, prior employment history, prior exposure history, and other conditions that might bear upon subsequent events once employment begins. The preplacement examination includes:

- Occupational history, including previous chemical and carcinogenic exposures.
- Medical history including demographic data, family history, personal habits, and past medical history.
- Fertility history.
- Physical examination, stressing examination of the neurologic, cardiopulmonary, musculoskeletal, and dermatological systems.
- Physiological parameters including blood pressure and heart rate.
- Pulmonary function testing including FVC, FEVI, and FEV 25-75.
- Electrocardiogram.
- PA and lateral chest X-ray.
- A multichemistry panel including tests of kidney and liver function.
- Red blood cell cholinesterase.
- Audiogram.

The history, physiological parameters, X-ray, screening tests, and laboratory studies will be conducted before the physical examination. After the physical examination, the medical examiner will review the results with each employee and will offer, as appropriate, referrals for further evaluation of abnormalities detected. The health and safety officer will provide each employee with a written summary and detailed results of the examination, along with any job restrictions. Additional medical testing procedures (e.g., ophthalmology/optometric assessment, specialized audiometric testing) may be required at the discretion of E/A&H's attending physician.

7.2 Periodic and Exit Examinations

An examination and updated occupational history will be repeated annually and include:

- Updated occupational and medical history.
- Physical examination, stressing examination of the neurologic, cardiopulmonary, musculoskeletal, and dermatological systems.
- Pulmonary function testing including FVC, FEVI, and FEV 25-75.
- Multichemistry panel including tests of kidney and liver function.
- Urinalysis.

The company doctor will review the results of annual examination and exposure data, and request further tests or issue medical clearances as appropriate. An examination also will be administered when an employee leaves the company. The company doctor will be consulted for the contents of the exam, except when the employee has had one within six months or when there has been no site work since the last examination.

7.3 Project-Specific Monitoring

Occasionally site work may potentially expose personnel to unusual chemical hazards or high concentrations of highly toxic compounds. In these cases, E/A&H may choose to expand its medical monitoring program to include biological monitoring, medical diagnostic testing, or medical screening procedures. These tests and procedures may require pre- and/or post-site (exposure) medical examination, consultation or testing with the company physician, or possibly a designated medical specialist. Project staff must comply with project-specific medical monitoring requirements or they shall not be allowed to participate in field work for that project.

When projects may involve unusual exposure risks, the project manager should consult with the PHSO and/or the company doctor concerning the scope of work, known or anticipated chemical hazards, and the need for additional medical monitoring requirements for project staff. If

project-specific monitoring is established, all E/A&H record-keeping and confidentiality procedures shall be followed.

7.4 Post-Exposure and Return-to-Work Examinations

After any job-related injury or illness, a medical examination is required to determine fitness for duty or to identify any job restrictions. The medical examiner will review the results of this back-to-work examination with the company doctor before allowing the employee to return to work. A similar examination will be performed if an employee has missed at least three days of work due to a non-job-related injury requiring medical attention. Medical records shall be maintained by the employer or the physician for at least 30 years following the termination of employment.

7.5 Confidentiality

Medical records will be maintained in a confidential manner so that only authorized people will have access. The authorized personnel will include medical staff of the joint venture or contract medical personnel, the individual, the individual's personal physician, or the individual's designated representative. Upon request, the individual may obtain a copy of the medical file, which will be provided within 15 days of the written request's receipt. Information used for research, testing, statistical, or epidemiologic purposes will have all identifying data removed, including the individual's name. Any medical information or findings obtained that do not affect the individual's job performance will not be made available to E/A&H in order to maintain the patient-physician confidentiality. Upon death, retirement, resignation, or other termination of services, the records will be retained by E/A&H or contracting physician.

8.0 AUTHORIZED PERSONNEL

Personnel anticipated to be onsite at various times during site activities include:

• Principal-In-Charge	James Speakman (E/A&H)
• Task Order Manager	Todd Haverkost (E/A&H)
• Project Health and Safety Officer	David Isenberg (E/A&H)
• Field Environmental Scientist	To be determined (E/A&H)
• Field Geologist	To be determined (E/A&H)
• Site Supervisor	Sam Weatherford (E/A&H)
• Site Health and Safety Officer	Tim McCord (E/A&H)
• Engineer-In-Charge	Tony Hunt (SOUTHNAVFACENGCOM) Brian Stockmaster (SOUTHNAVFACENGCOM)
• Site Contact	Joe Camp (Caretaker Site Officer)

A summary of the health and safety responsibilities of key site personnel follows. Personnel assigned to these functions may change during the course of this project. Also, when more than one task or site is being worked at the same time, multiple people may serve in these roles, i.e., there will be a SHSO for each site being worked.

8.1 Responsibilities of Site Supervisor

The site supervisor will direct site operations and, relative to health and safety, is responsible for assuring that:

- Field staff follow the CHASP, ZHASP, and other safety and health standard operating procedures (SOPs). Personnel who repeatedly do not comply shall be retrained and/or instructed to leave the site and not allowed to return.
- Field staff have current HAZWOPER training.

- Field staff know who the PHSO and SHSO are.
- Field staff know the site-specific health and safety concerns.
- There is an adequate onsite supply of health and safety equipment.
- Field staff participate in the E/A&H medical surveillance program (or in the case of subcontractors, an equivalent program).
- Field staff attend health and safety "kick-off" orientation and other site safety briefings.

The site supervisor also is responsible for assuring that field staff who may be exposed to unique or special hazards have the training or experience necessary to safely conduct their work.

8.2 Responsibilities of Site Health and Safety Officer

The responsibilities of the site health and safety officer include:

- Providing the site supervisor technical input on site health and safety issues.
- Observing field personnel and reporting to the site supervisor on the effectiveness of the CHASP and ZHASP and whether field staff are using proper work practices and decontamination procedures.
- Reporting significant safety violations to the project manager and/or PHSO.
- Conducting safety briefings as he/she deems appropriate, or when requested by the site supervisor.
- Assuring that a copy of the appropriate health and safety plans are maintained onsite during field activities.
- Maintaining a file of HAZWOPER training certificates and appropriate refresher training certificates for onsite personnel.

The SHSO will have the following qualifications: (1) 40 hours of OSHA training or equivalent experience, (2) 24 hours of supervisory training or equivalent experience, (3) knowledge of the health and safety concerns for the specific work tasks being conducted, and (4) trained in use

of the air-monitoring equipment, (5) able interpret the data collected with the instruments, (6) be familiar with symptoms of chemical exposure, heat stress, and cold exposure, and (7) know the location and proper use of onsite safety equipment. He/she will also be familiar with this health and safety plan.

8.3 Responsibilities of Onsite Field Staff

The health and safety responsibilities of field staff include:

- Being familiar with and complying with the CHASP and ZHASP.
- Attending site health and safety briefings and being aware of anticipated chemical, physical, and biological hazards and knowing what to do when these hazards are encountered.
- Being trained on PPE use, safe work practices, decontamination procedures to be followed, emergency procedures, and communications.
- Properly using required PPE, including respiratory protective equipment.
- Having up-to-date HAZWOPER training and providing the site supervisor with documentation of that training.
- Being an up-to-date participant in the E/A&H medical monitoring program.
- Using the buddy system when wearing respiratory protective equipment.
- Being fit-tested and physically capable of using a respirator (if/when one is required). Should respiratory protection be required, field workers shall not have facial hair that interferes with its proper fit.

In addition, field staff always should be alert and use their senses (sight, smell, etc.) to identify and react to potentially dangerous situations. When working in the EZ, visual contact should be maintained with other personnel in the area; field personnel should be close enough to assist each other during an emergency. Procedures for leaving the EZ must be planned and all necessary equipment present before entering the EZ.

To maintain effective site operations, minimize the number of personnel and equipment in the contaminated area. Site visitors shall comply with the CHASP and ZHASP, and have the same responsibilities as field staff. PPE requirements may be modified for visitors, depending on the situation. Modifications must be approved by the PHSO.

9.0 EMERGENCY INFORMATION

All hazardous waste site activities present a risk to onsite personnel. During routine operations, risk is minimized by establishing good work practices, staying alert, and using proper PPE. Unpredictable events such as physical injury, chemical exposure, or fire may occur and must be anticipated.

If any situation or unplanned occurrence requires outside emergency assistance, immediately call the appropriate contact from the following list:

Contact	Agency or Organization	Telephone
Joe Camp	NAVBASE Site Contact	(803) 743-5519
Tony Hunt Brian Stockmaster	SOUTHNAVFACENGCOM Engineers-in-Charge	(803) 820-5525 (803) 820-7481
Chief of Watch (May serve as a point of contact for any emergency)	NAVBASE	(803) 743-4642
Law Enforcement	NAVBASE Security	(803) 743-5555
Fire Department	NAVBASE Fire Department	(803) 743-5333
Ambulance Service	NAVBASE Ambulance	(803) 743-5444
Hospital	Charleston Naval Hospital* Roper Hospital North*	(803) 743-7000 (803) 744-2110
Southern Poison Control Center		(800) 922-1117

David Isenberg	E/A&H PHSO	(615) 399-8800
Todd Haverkost	EnSafe/Allen & Hoshall Project Geologist	(803) 884-0029 office (803) 747-0336 field office (803) 971-0189 night

* Use Charleston Naval hospital for (potentially) life-threatening situations. For medical needs that are less urgent, the Naval Hospital will not provide service to civilians; Roper Hospital North is the next closest facility.

As soon as practical, Joe Camp, NAVBASE Site Contact; Tony Hunt or Brian Stockmaster, SOUTHNAVFACENGCOM Engineer-in-Charge; Todd Haverkost, E/A&H project manager; and David Isenberg, E/A&H PHSO, shall be fully apprised of the situation. Other persons, as appropriate, also may need to be contacted.

9.1 Site Resources

A cellular telephone will be available in the SZ for routine and emergency communication/ coordination with NAVBASE, SOUTHDIV, and the E/A&H field office. First-aid and eye wash equipment will be available at the work area.

9.2 Emergency Procedures

Examples of an emergency include:

- A fire, explosion, or similar event occurring at or near the site, whether related to this project or not;
- A member of the field crew sustains a significant injury, or experiences symptoms of chemical exposure; or
- The discovery of a condition suggesting site conditions are imminently more dangerous or hazardous than anticipated.

In the event of an emergency, the following emergency procedures should be followed:

- If it is necessary to evacuate the area, immediately proceed to a rally point and remain there until instructed otherwise.
- Use planned escape routes.
- In the event that a member of the field team experiences effects or symptoms of exposure while on the scene, the field crew will immediately halt work and act according to the instructions provided by the site supervisor or, in his absence, the SHSO.
- For applicable site activities, including all Level B activities, wind indicators will be used to continuously indicate downwind, preferred escape routes, from upwind routes.
- Investigate condition(s) suggesting site conditions may be more hazardous than anticipated. The condition observed and the decisions made shall be recorded in the safety log book, or in the field log book if a safety log is not being maintained. If there are any doubts about how to proceed, suspend work and back away from the work area until the PHSO has evaluated the situation and provided the appropriate instructions to the field team.
- If an accident occurs, the site supervisor is to complete an Accident Report Form (see Appendix A) for submittal to the managing principal-in-charge of the project.
- If a member of the field crew suffers a personal injury, the SHSO will call NAVBASE Fire Department 743-5333 or 5444 if an ambulance is needed. Next, alert appropriate emergency response agencies as the situation dictates. An Accident Report Form will be completed for any such incident.
- If a member of the field crew suffers chemical exposure, the affected areas should be flushed immediately with copious amounts of clean water and, if the situation dictates, the SHSO should alert appropriate emergency response agencies, or personally ensure the exposed individual is transported to the nearest medical treatment facility for prompt treatment. (See Appendix C for directions to the emergency medical facility.) An Accident Report Form will be completed for any such incident.

Additional information on appropriate chemical exposure treatment methods will be provided through MSDS in Appendix B of the ZHASP. Directions to the nearest emergency medical facility capable of providing general emergency medical assistance and treating chemical burns are provided in Appendix C of this CHASP. Directions from individual sites to the South Gate will be provided as Appendix D of the ZHASP.

10.0 FORMS

The following forms will be used in implementing this health and safety plan:

- Plan Acceptance Form
- Plan Feedback Form
- Exposure History Form
- Accident Report Form

A ZHASP Plan Acceptance Form will be filled out by all employees working on the site before activities begin. The Plan Feedback Form will be filled out by the site safety officer and any other onsite employee who wishes to fill one out. Should and E/A&H employee develop symptoms that may (are likely) to be attributable to their work an Exposure History Form will be completed. This form shall be completed with input from both the Site Supervisor and the individual(s) with the symptoms.

An Example of each form is provided in Appendix A of this plan.

Completed forms must be returned to the Task Order Manager at EnSafe/Allen & Hoshall, Memphis, Tennessee.

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APPENDIX A

HEALTH AND SAFETY PLAN FORMS

PLAN ACCEPTANCE FORM
PROJECT HEALTH AND SAFETY PLAN

INSTRUCTIONS: This form is to be completed by each person working on the project work site and returned to EnSafe/Allen & Hoshall, Memphis, Tennessee.

Job No: 0029-00104

Contract No: N62467-89-D-0318

Project: Comprehensive Health and Safety Plan

I represent that I have read and understand the contents of the above plan and agree to perform my work in accordance with it.

_____

Signed

_____

Printed Name

_____

Company

_____

Date

EMPLOYEE EXPOSURE HISTORY FORM

Employee: _____

Job Name: _____

Date(s) From/To: _____

Hours Onsite: _____

Contaminants (Suspected/Reported): _____

_____

(See Attached Laboratory Analysis)

PLAN FEEDBACK FORM

Problems with plan requirements:

Unexpected situations encountered:

Recommendations for revisions:

ACCIDENT REPORT FORM

SUPERVISOR'S REPORT OF ACCIDENT	DO NOT USE FOR MOTOR VEHICLE OR AIRCRAFT ACCIDENTS
TO	FROM TELEPHONE (Include area code)
NAME OF INJURED OR ILL WORKER AND COMPANY	
WORKER'S SOCIAL SECURITY NUMBER	

DATE OF ACCIDENT	TIME OF ACCIDENT	EXACT LOCATION OF ACCIDENT

NARRATIVE DESCRIPTION OF ACCIDENT	
NATURE OF ILLNESS OR INJURY AND PART OF BODY INVOLVED	LOST TIME YES ☐ NO ☐

PROBABLE DISABILITY (Check one)

FATAL ☐	LOST WORK DAY WITH ____DAYS AWAY FROM WORK	LOST WORK DAY WITH ____DAYS OF RESTRICTED ACTIVITY	NO LOST WORK DAY ☐ FIRST AID ONLY ☐

CORRECTIVE ACTION RECOMMENDED (By whom and by when)

NAME OF SUPERVISOR	TITLE
SIGNATURE	DATE

APPENDIX B

DRILLING SAFETY GUIDE

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Drilling Safety Guide

Ensafe/Allen & Hoshall is concerned about employee safety while working on or around drill rigs, as well as when traveling to and from a drilling site, moving the drill rig and tools from location to location on a site, and during drill rig maintenance. Each drill crew will have a designated safety supervisor. The safety supervisor will be responsible for ensuring that all drilling operations are conducted safely. All personnel working on, with, or around a drill rig will be under the rig safety supervisor's jurisdiction.

Drill Rig Safety Supervisor

The safety supervisor for the drill crew will be the drill rig operator. However, the E/A&H safety officer still maintains the overall safety responsibility for the site. The drill crew safety supervisor is a direct representative of the site health and safety supervisor and will report any safety problems directly to the site health and safety officer. The drill rig safety supervisor will:

- Be the leader in using proper personal protective equipment (PPE). He/she will set an example for other personnel to follow.
- Enforce the requirements of the health and safety plan and take appropriate actions when other personal are not following the health and safety plan's requirements.
- Ensure that all drill rig and associated equipment are properly maintained.
- Ensure that all drill rig operating personnel are thoroughly familiar with the drill operations.
- Inspect the drill rig and associated equipment for damage before starting drilling operations. Check for structural damage, loose bolts or nuts, correct tension in chains and cables, loose or missing guards or protective covers, fluid leaks, damaged hoses, and/or damaged pressure gauges and pressure-relief valves.
- Test all emergency and warning devices such as emergency shut-down switches at least daily (before starting drilling operations). Drilling will not be permitted until all emergency and warning devices are functioning.

- Conduct a safety briefing daily before starting drilling operations. Any new employee will receive a copy of the drilling operations safety manual, and the drill rig manufacturer's operating and maintenance manual.
- Ensure that each employee reads and understands the drill rig manufacturer's operating and maintenance manual.
- Observe the mental, emotional, and physical capabilities of each worker.
- Ensure that each drill rig has a first-aid kit and fire extinguisher.
- Maintain a list of emergency contact telephone numbers. This list will be prominently posted and each drill rig employee will be informed of the list's location.

Drill Rig PPE

For most geotechnical, mineral, and/or groundwater drilling, drill rig PPE will include the following:

- Hard hat
- Safety shoes with steel toe and steel shank (or equivalent)
- Gloves
- Safety glasses with side shields
- Close-fitting but comfortable clothes
- Hearing protection

It is important that clothing does not have loose ends, straps, draw strings, belts, or other unfastened parts that might become caught in or on a rotating or translating part of the drill rig.

Rings, necklaces, or other jewelry will not be worn during drilling operations.

Additional protective equipment may be required by the site-specific health and safety plan.

Drill Rig Housekeeping

The following housekeeping measures must be taken for all drilling operations.

- Suitable storage locations will be provided for all tools, materials, and supplies. The storage should be conveniently located and will provide for safe handling of all supplies.
- Drill tools, supplies, and materials will not be transported on the drill rig unless it is designed and equipped to carry drill tools, supplies, and materials.
- Stored pipe, drill rods, casing, augers, and similar drilling tools will be stacked in a manner that will prevent spreading, rolling, or sliding.
- Penetration or other driving hammers will be secured to prevent movement when not in use.
- Work areas, platforms, walkways, scaffolding, and other access ways will be kept free of materials, debris, obstructions, and substances such as ice, grease, or oil that could make a surface slick or otherwise hazardous.
- Never store gasoline in a non-approved container. Red, non-sparking, vented containers marked with the word gasoline will be used. The fill spout will have a flame arrester.
- Before drilling, the site will be adequately cleared and leveled to accommodate the drill rig and supplies and to provide a safe working area. Drilling will not be started when tree limbs, unstable ground, or site obstructions make tool handling unsafe.

Maintenance Safety

Well-maintained drilling equipment makes drilling operations safer. When performing equipment/tool maintenance, the follow safety precautions will be followed:

- Safety glasses will be worn when maintenance is performed on drill rigs or drilling tools.
- Shut down the drill rig engine to repair or adjust the rig or to lubricate fittings (except for repairs or adjustments that must be made while the engine is running).
- Always block the wheels or lower the leveling jacks or both. Set the hand brake before working under a drill rig.

- Release all pressure on hydraulic systems, the drilling fluid system, and the air operating system of the drill rig prior to maintenance.
- Use extreme caution when opening drain plugs and radiator caps and other pressurized plugs and caps.
- Allow time for the engine and exhaust to cool before maintaining these systems.
- Never weld or cut on or near the fuel tank.
- Do not use gasoline or other volatile or flammable liquids as cleaning agents.
- Follow the manufacturer's recommendations for quantity and type of lubricants, hydraulic fluids, and coolants.
- Replace all caps, filler plugs, protective guards or panels, and high-pressure hose clamps and chains or cables that have been removed during maintenance.
- Perform a safety inspection before starting drilling equipment after maintenance is performed.

Safe Use of Hand Tools

There are a large number of hand tools that can be used on or around a drill rig. The most important rule of hand tools is to use a tool for its intended purpose. The following are a few general and specific safety rules to follow when using hand tools.

- When using a hammer, wear safety glasses and require all others around you to wear them.
- When using a chisel, wear safety glasses and require all others around you to wear them.
- Keep all tools cleaned and stored in an orderly manner.
- Use wrenches on nuts, not pliers.
- Use screwdrivers with blades that fit the screw slot.
- When using a wrench on a tight nut, use some penetrating oil, use the largest wrench available that fits the nut, when possible pull on the wrench handle rather than pushing, and apply force to the wrench with both hands when possible and with both feet firmly placed. Don't push or pull with one or both feet on the drill rig or the side of a mud pit

or some other blocking-off device. Always assume that you may lose your footing. Check the place where you may fall for sharp objects.

- Keep all pipe wrenches clean and in good repair. The jaws of pipe wrenches will be wire brushed frequently to prevent dirt and grease accumulations that make wrenches slip.
- Never use pipe wrenches in place of a rod-holding device.
- Replace hock and heel jaws when visibly worn.
- When breaking tool joints on the ground or on a drilling platform, position hands so that fingers will not be smashed between the wrench handle and the ground or the platform if the wrench were to slip or the joint suddenly to let go.

Safety During Drilling Operations

- Do not drive a drill rig from hole to hole with the mast (derrick) raised.
- Before raising the mast, check for overhead obstructions.
- Before raising the mast, all drill rig personnel (except the person raising it) and visitors will be cleared from the area immediately to the rear and sides of the mast. All drill rig personnel and visitors will be informed that the mast is being raised before doing so.
- All drill rig personnel and visitors will be instructed to stand clear immediately before and while starting the engine.
- All gear boxes will be in the neutral position, all hoist levers will be disengaged, all hydraulic levers will be in the non-actuating positions, and the cathead rope will not be on the cathead before starting the drill rig engine.
- The drill rig must be leveled and stabilized with leveling jacks and/or solid cribbing before the mast is raised. The drill rig will be leveled if settling occurs after initial set-up.
- The mast will be lowered only when the leveling jacks are down. The leveling jacks must be down until the mast is completely lowered.
- Secure and/or lock the mast according to the drill rig manufacturer's recommendations before starting drilling operations.

- The drill rig must only be operated from the control position. If the operator must leave the control position, the rotary drive and the feed control must be placed in the neutral position. The drill engine will be shut down when the operator leaves the vicinity of the drill rig.
- Throwing or dropping tools is not permitted. All tools will be carefully passed by hand between personnel or a hoist line will be used.
- When drilling within an enclosed area, ensure that fumes are vented out of the area. Exhaust fumes can be toxic and may not be detected by smell.
- Clean mud and grease from boots before mounting the drill platform. Use handholds and railings. Watch for slippery ground when dismounting from the drill platform.
- Do not touch any metal parts of the drill rig with exposed flesh during freezing weather. Moist skin can freeze to metal almost instantaneously.
- All unattended boreholes must be covered or otherwise protected to prevent drill rig personnel, site visitors, or animals from stepping or falling into the hole.
- Do not attempt to use one or both hands to carry tools when climbing ladders.

Working on Derrick Platforms

- When working on a derrick platform, us a safety belt and a lifeline. The safety belt will be at least 4 inches wide and will fit snugly but comfortably. The lifeline will be less than 6 feet long and attached to the derrick.
- The safety belt and lifeline will be strong enough to withstand the dynamic force of a 250-pound weight falling 6 feet.
- A safety climbing device will be used when climbing to a derrick platform higher than 20 feet.
- The lifeline will be fastened to the derrick just above the derrick platform to a structural member that is not attached to the platform or to other lines or cables supporting the platform.
- Tools will be securely attached to the platform with safety lines. Do not attach a tool to a line attached to the wrist or other body part.

- When working on a derrick platform, do not guide drill rods or pipe into racks or other supports by taking hold of a moving hoist line or a traveling block.
- Derrick platforms more than 4 feet above the ground will have toe boards and safety railings.

Working on the Ground

- Workers on the ground must avoid going under elevated platforms.
- Terminate drilling operations and, if possible, lower the mast during an electrical storm.
- Overhead and buried utilities must be located and marked on all boring location plans and boring assignment sheets.
- When overhead electrical power lines are at or near a drilling site or project, consider all wire charged and dangerous.
- Watch for sagging power lines before entering a site. Do not lift power lines to gain entry. Call the utility to have it lift the power lines or to de-energize the power.
- Operations adjacent to overhead lines are prohibited unless one of the following conditions is satisfied:

  — Power has been shut off and positive means taken to prevent the lines from being energized.

  — Equipment, or any part, does not have the capability of coming within the following minimum clearance from energized overhead lines, or the equipment has been positioned and blocked to assure no part, including cables, can come within the following minimum clearances:

Power lines nominal system kv	Minimum required clearance
0 — 50	10 feet
51 — 100	12 feet
101 — 200	15 feet

Power lines nominal system kv	Minimum required clearance
201 — 300	20 feet
301 — 500	25 feet
501 — 750	35 feet
751 — 1000	45 feet

- While in transit with boom lowered and no load, the equipment clearance will be a minimum of 4 feet for voltages less than 50kv, 10 feet for voltages 51kv to 345kv, and 16 feet for voltages higher than 345kv.
- Before working near transmitter towers where an electrical charge can be induced in the equipment or materials being handled, the transmitter will be de-energized. The following precautions will be taken to dissipate induced voltages:
  - The equipment will be provided with an electrical ground to the upper rotating structure supporting the boom.
  - Ground jumper cables will be attached to materials being handled by boom equipment when electrical charge may be induced while working near energized transmitters. Crews will be provided non-conductive poles having large alligator clips or other similar protection to attach the ground cable to the load. Insulating gloves will be used.
- Continue to watch overhead power lines. Wind can move both hoist lines and overhead power lines toward each other.
- If there are any questions concerning drill rig operations on a site near overhead power lines, call the power company. The power company will provide expert advice as a public service.
- Look for warning signs indicating underground utilities. Underground utilities may be a considerable distance from the warning sign. Call the utility and jointly determine the precise location of all underground utility lines, mark and flag the locations, and determine the specific precautions to be taken to ensure safe drilling operations.

Wire Rope Safety

- All wire ropes and fittings will be visually inspected at least weekly for abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper reeving, jamming, crushing, bird caging, kinking, core protrusion, and damage to lifting hardware.
- Wire ropes must be replaced when inspection indicates excessive damage. The *Wire Rope User's Manual* may be used as a guide for determining excessive damage.
- Wire ropes that have not been used for a month or more will be thoroughly inspected before returning to service.
- All manufactured and end fittings and connections must be installed according to the manufacturer's specifications.
- Swivel bearings on ball-bearing type hoisting swivels must be inspected and lubricated daily to ensure that the swivel rotates freely under load.
- Do not drill through or rotate drill through a slipping device, do not hoist more that 10 feet of the drill rod column above the top of the last (mast), do not hoist a rod column with loose tool joints, and do not make up, tighten, or loosen tool hoists while the rod column is being supported by a rod-slipping device.
- Do not attempt to brake the fall of a drill rod column with your hands or by increasing tension on the rod-slipping device.
- Wire ropes must be properly matched with each sheave. The sheave will pinch wire rope that is too large. Wire rope that is too small will groove the sheave. Once a sheave is grooved, it will severely pinch and damage larger-size wire rope.
- Use tool-handling hoists only for vertically lifting tools. Do not use tool-handling hoists to pull on objects away from the drill rig.
- All hoisting hooks will be equipped with safety latches.
- When tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the tools directly to the drill's feed mechanism. Do not use hydraulic leveling jacks for added pull for the hoist line or the drill feed mechanism.
- Minimize shock loading of a wire rope; apply loads smoothly and steadily.

- Avoid sudden loading in cold weather.
- Never use frozen ropes.
- Protect wire rope from sharp corners or edges.
- Replace faulty guides and rollers.
- Replace worn sheaves or worn sheave bearings.
- Know the safe working load of the equipment and tackle. Never exceed safe working limits.
- Periodically inspect clutches and brakes of hoists.
- Always wear gloves when handling wire ropes.
- Do not guide wire rope onto hoist drums with your hands.
- After installing a new wire rope, the first lift must be a light load to allow the rope to adjust.
- Never leave a load suspended when the hoist is unattended.
- Never use a hoist line to ride up the mast.

Cathead and Rope Hoist Safety

- Keep the cathead clean and free of rust, oil, and/or grease. The cathead must be cleaned with wire brush when it becomes rusty.
- Check the cathead for rope-wear grooves. If a rope groove is deeper that ⅛ inch, the cathead must be replaced.
- Always start work with a clean, dry, sound rope. A wet or oily rope may grab the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast. If the rope grabs the cathead or otherwise becomes tangled in the drum, release it and sound the alarm for all personnel to clear the area rapidly.
- The rope must not be permitted to touch chemicals.
- Never wrap the rope from a cathead around a hand, wrist, arm, foot, ankle, leg, or any other body part.
- Attach the hammer to the rope using a knot that will not slip, such as a bowline.

- A minimum of 18 inches must be maintained between the operating hand and the cathead drum when driving samplers, casing, or other tools. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground. Loosen grip on the rope as the hammer falls. Maintaining a tight grip on the rope increases the chances of being pulled into the cathead.
- Do not use a rope that is longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.
- Do not leave a cathead unattended with the rope wrapped on the drum.
- Position all other hoist lines to prevent contact with the operating cathead rope.
- The cathead operator must be on a level surface with good, firm footing.

Auger Safety

- The drill rig must be level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at low revolutions per minute (RPM) when starting an auger boring.
- Seat the auger head below the surface with an adequate amount of downward pressure prior to rotation.
- Observe the auger head while slowly engaging the clutch or rotation control and start rotation. Stay clear of the auger.
- Slowly rotate the auger and auger head while continuing to apply downward pressure. Keep one hand on the clutch or the rotation control at all times until the auger has penetrated about 1 foot or more below the surface.
- Follow manufacturer's recommended methods for securing the auger to the power coupling.
- Never place hands or fingers under the bottom of an auger section when hoisting it over the top of the auger section in the ground or other hard surfaces, such as the drill rig platform.
- Never place feet under the auger section being hoisted.
- Stay clear of rotating augers and other rotating components of the drill rig.

- Never reach behind or around a rotating auger.
- Use a long-handle shovel to move auger cuttings away from it.
- Augers will be cleaned only when the drill rig is in neutral and they have stopped rotating.

Rotary and Core Drilling Safety

- Water swivels and hoist plugs must be lubricated and checked for frozen bearings before use.
- Drill rod chuck jaws must be checked periodically and replaced as necessary.
- The weight of the drill rod string and other expected hoist loads must not exceed the hoist and sheaves capacities.
- Only the operator of the drill rig will brake or set a manual chuck to ensure it will not rotate before removing the wrench from the chuck.
- The drill rod chuck jaws will not be used to brake drill rods during lowering into the hole.
- Drill rods will not be held or lowered into the hole with pipe wrenches.
- Do not attempt to grab falling drill rods with hands or wrenches.
- In the event of a plugged bit or other circulation blockage, the high pressure in the piping and hose between the pump and the obstruction must be relieved or bled down before breaking the first tool joint.
- Use a rubber or other suitable rod wiper to clean rods during removal from the hole. Do not use hands to clean drilling fluids from the drill rods.
- Do not lean unsecured drill rods against the mast.

APPENDIX C

DIRECTIONS TO EMERGENCY MEDICAL FACILITIES

DIRECTIONS TO THE CHARLESTON NAVAL HOSPITAL

The nearest hospital to the site is the Charleston Naval Hospital. This hospital should be used for all life threatening medical emergencies. For other medical services, please use Baker Hospital.

Nearest Hospital

Charleston Naval Hospital
McMillan Road
Charleston, South Carolina

Emergency Room Telephone Number:	(803) 743-7011
General Information Number:	(803) 743-7000

Directions to Charleston Naval Hospital From Main Gate of the Charleston Naval Shipyard:

1) Refer to the following figure, Map to the Charleston Naval Hospital.

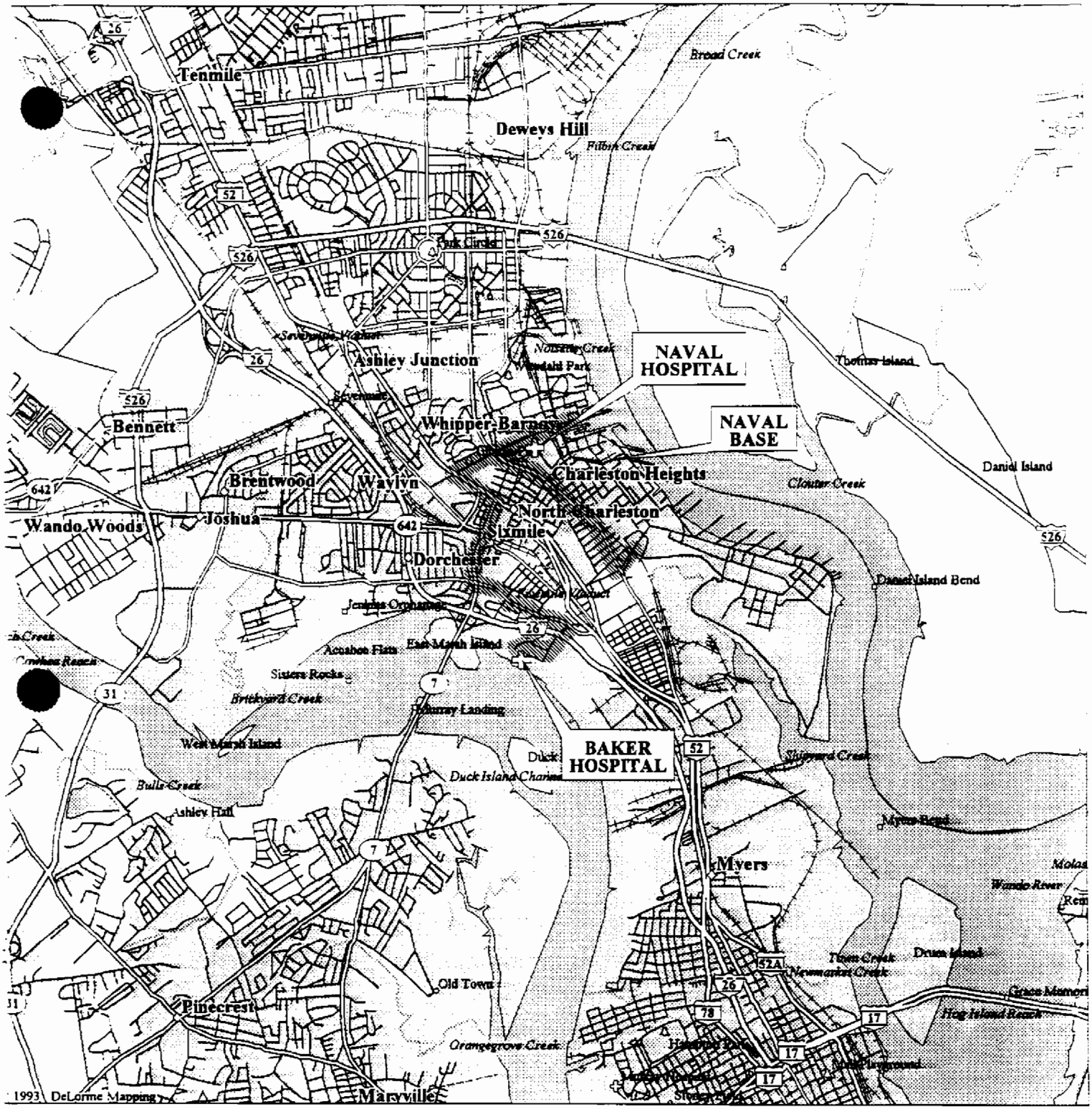
2) Exit naval base via the Main Gate (McMillan Gate).

3) Proceed west, toward Rivers Road.

4) At the intersection of McMillan and Rivers, the hospital is on the left.
   — Hospital entrance is just before the intersection.
   — Hospital is approximately 1/2-mile from the Main Gate.

Before starting a phase of work, Baker Hospital should be notified of the estimated work schedule involving invasive activities.

If high concentrations of highly toxic chemicals are known or anticipated, Baker Hospital should be notified of these conditions.



LEGEND

- Population Center
- State Route
- Geo Feature
- Town, Small City
- Hospital
- Park
- Interstate, Turnpike
- US Highway
- Street, Road
- Hwy Ramps
- Street, Road
- Major Street/Road
- State Route
- Interstate Highway
- US Highway
- Railroad
- Airfield
- Land Mass
- Open Water

Mag 13.00
Fri Jun 24 18:37:09 1994

Scale 1:62,500 (at center)

1 Miles

2 KM